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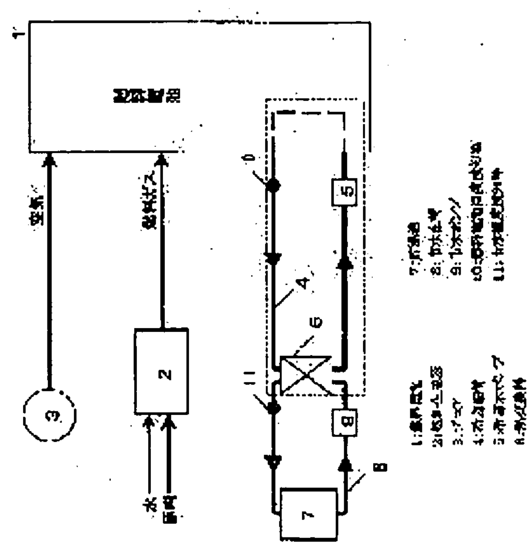
(54) FUEL CELL SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a fuel cell system which effectively collect the heat generated by a fuel cell.

SOLUTION: The fuel cell system comprises a fuel cell 1 generating electric power according to the supply of fuel and oxidant, a cooling pipe 4 arranged so as to pass through the inside of the fuel cell 1, in which, a first thermal medium carrying the heat of the fuel cell circulates, a cooling water pump 5 making the first thermal medium circulate in the cooling pipe, a heat exchanger 11 arranged at the other part of the cooling pipe 4 for the radiation of the heat of the first thermal medium, and a fuel cell temperature detecting device 10 detecting the temperature of the fuel cell. The fuel cell operates until the temperature detected by the fuel cell temperature detecting device 10 becomes lower than a prescribed threshold value after the supply of fuel and oxidant is stopped.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the fuel cell system which generates electricity using a fuel cell.
[0002]
[Description of the Prior Art] Below, the conventional fuel cell system is explained.
[0003] As shown in drawing 3 , the conventional fuel cell system Fuel gas, the fuel cell 1 which generates electricity using an oxidizer, and the fuel generation machine 2 which generates the fuel gas which added and reformed water in generation-of-electrical-energy raw materials, such as natural gas, and was rich in hydrogen, Blois 3 which supplies the air as an oxidizing agent to a fuel cell 1, and the cooling piping 4 which makes cooling water circulate to a fuel cell 1 as the 1st heat carrier which takes out to the exterior the heat which a fuel cell 1 generates, It becomes the city-water piping 8 which connects the cooling water pump 5 which is located in the cooling piping 4 and conveys cooling water, the heat exchanger 6 which transmits the heat of the cooling water as the 1st heat carrier to the city water as the 2nd heat carrier, ****** 7 which stores a city water, and a heat exchanger 6 and ****** 7 from the city water feed pump 9 which conveys a city water.
[0004] A fuel cell 1 generates power and heat from the fuel gas which was rich in the hydrogen generated with the fuel generation vessel 2, and the air which Blois 3 supplies. The fuel generation machine 2 is maintained by the elevated temperature (about 700 degrees C) with the burner (not shown) which burns natural gas etc. in order to generate the fuel gas which added water in generation-of-electrical-energy raw materials, such as natural gas, and was rich in hydrogen.
[0005] The heat generated with the fuel cell 1 is conveyed outside with the cooling water which flows the inside of the cooling piping 4. The flow rate of cooling water adjusts the conveyance capacity of a cooling water pump 5 so that the temperature Tf of the cooling water which the fuel cell temperature detector 10 installed in the place where cooling water flows out of a fuel cell 1 detects may be in agreement with the target temperature Tr1 (about 70 degrees C). Here, it is considered that the temperature as which the fuel cell temperature detector 10 detects temperature since it is thought that the temperature of a fuel cell 1 is almost equal to the temperature which flows out of a fuel cell 1 is the temperature of a fuel cell 1.
[0006] The heat which cooling water obtained is transmitted to the city water which flows the inside of the city-water piping 8 through a heat exchanger 6. The flow rate of a city water adjusts the conveyance capacity of a city water feed pump 9 so that the temperature Tw of the city water which the city-water temperature detector 11 installed in the place where a city water flows out of a heat exchanger 6 detects may be in agreement with the target temperature Tr2 (about 60 degrees C).
[0007] in such a fuel cell system, in case a generation of electrical energy of a fuel cell 1 is ended, generally discarding out of a fuel cell system is performed [combustible gas / delivery and] in inert gas, such as nitrogen, to suspending supplying a generation-of-electrical-energy raw material to the fuel generation machine 2 simultaneously the fuel generation machine 2, and the distribution channel of the material gas of a fuel cell 1, and fuel gas. Moreover, since a fuel cell 1 stops generating heat in a generation-of-electrical-energy halt and coincidence, a cooling water pump 5 and a city water feed pump 9 also suspend conveyance actuation to them, and it also suspends circulation of cooling water and a city water to them.
[0008]
[Problem(s) to be Solved by the Invention] In a fuel cell system like the above-mentioned conventional example, after generation-of-electrical-energy termination and from the inside of the fuel generation machine 2 of about 700 degrees C, inert gas, such as nitrogen which has gone via the distribution channel of fuel gas, passes a fuel cell 1, and is discharged from a fuel cell 1 outside.
[0009] However, the fuel gas which remains to the fuel generation machine 2 and the distribution channel at

this time will pass through the inside of a fuel cell 1 in the form backed up for inert gas, maintaining that temperature mostly, and will be discharged outside. Therefore, the interior of a fuel cell 1 can consider that only the part which this fuel gas passes becomes an elevated temperature.

[0010] Although the solid-state poly membrane used for an electrolyte needs a humid thing when the solid-state macromolecule mold is used for the fuel cell 1, if an elevated temperature and the inert gas which is not humidified flow near the solid-state poly membrane, the situation which a solid-state poly membrane dries partially will occur, and it becomes the cause of reducing the generating efficiency of a fuel cell 1 remarkably.

[0011] Next, even if a fuel cell 1 suspends a generation of electrical energy, while fuel cell 1 self is for a while, the temperature of about 70 degrees C is maintained. The heat which the fuel cell 1 holds since this is high temperature compared with environmental temperature was [only being emitted to the exterior, and], after suspending circulation of cooling water, and in order to use effectively the heat generated on the occasion of the generation of electrical energy, it needed to use the heat with which the fuel cell 1 holds after a generation of electrical energy.

[0012] This invention is made in view of the above-mentioned technical problem, and aims at obtaining the fuel cell system which does not cause the situation of reducing the generating efficiency of a fuel cell after generation-of-electrical-energy termination.

[0013] Moreover, this invention aims at obtaining the fuel cell system which can use the heat which a fuel cell holds also after generation-of-electrical-energy termination.

[0014]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the 1st this invention (it corresponds to claim 1) The cooling circulatory system to which the 1st heat carrier which supports the heat which the fuel cell which generates power in response to supply with a fuel and an oxidizer, and said fuel cell formed so that it might pass through the inside of said fuel cell have circulates through the interior, A heat carrier circulation means to circulate said 1st heat carrier within said cooling circulatory system, The heat dissipation means for making the heat which it is prepared in said a part of other cooling circulatory system, and said 1st heat carrier has radiate heat, It has a temperature detection means to detect the temperature of said fuel cell directly or indirectly. At least said heat carrier circulation means After supply to said fuel cell of said fuel and said oxidizer stops, it is the fuel cell system which operates until the temperature which said temperature detection means detects becomes below a predetermined threshold.

[0015] The 2nd this invention (it corresponds to claim 2) is the fuel cell system of the 1st this invention which operates said heat exchange after said heat dissipation means has the heat exchanger which performs heat exchange between said 1st heat carrier and 2nd heat carrier and supply to said fuel cell of said fuel and said oxidizer stops said heat exchanger until the temperature which said temperature detection means detects becomes below the threshold defined beforehand.

[0016] The temperature to which said temperature detection means detects the 3rd this invention (it corresponds to claim 3) is the fuel cell system of the 1st or 2nd this invention which is the temperature of said 1st heat carrier or said cooling circulatory system.

[0017] The temperature to which said temperature detection means detects the 4th this invention (it corresponds to claim 4) is the fuel cell system of the 2nd this invention which is the temperature of said 2nd heat carrier.

[0018] The fuel cell with which the 5th this invention (it corresponds to claim 5) generates power in response to supply with a fuel and an oxidizer, The cooling circulatory system which was established so that it might pass through the inside of said fuel cell and to which the 1st heat carrier which supports the heat which said fuel cell has circulates through the interior, A heat carrier circulation means to circulate said 1st heat carrier within said cooling circulatory system, The heat dissipation means for carrying out heat exchange of the heat which it is prepared in said a part of other cooling circulatory system, and said 1st heat carrier has to the 2nd heat carrier, It has a temperature detection means to detect the temperature of said 2nd heat carrier. Said heat carrier circulation means and/or said heat dissipation means After supply to said fuel cell of said fuel and said oxidizer stops, it is the fuel cell system which operates until the temperature which said temperature detection means detects becomes below a predetermined threshold.

[0019]

[Embodiment of the Invention] Below, the gestalt of operation of this invention is explained with reference to a drawing.

[0020] (Gestalt of the 1st operation) The fuel cell structure-of-a-system element by the gestalt of operation of the 1st of this invention was shown by the same <u>drawing 3</u> as the conventional example, and has given the same number about the same component.

[0021] As shown in <u>drawing 3</u> , the fuel cell system of the gestalt of this operation Fuel gas, the fuel cell 1 which generates electricity using an oxidizer, and the fuel generation machine 2 which generates the fuel gas

which added and reformed water in generation-of-electrical-energy raw materials, such as natural gas, and was rich in hydrogen, Blois 3 which supplies the air as an oxidizing agent to a fuel cell 1, and the cooling piping 4 which makes cooling water circulate to a fuel cell 1 as the 1st heat carrier which takes out to the exterior the heat which a fuel cell 1 generates, The cooling water pump 5 which is located in the cooling piping 4 and conveys cooling water, and the heat exchanger 6 which transmits the heat of the cooling water as the 1st heat carrier to the city water as the 2nd heat carrier, It has the city-water piping 8 which connects ****** 7 which stores a city water, and a heat exchanger 6 and ****** 7, and the city water feed pump 9 which conveys a city water.

[0022] Moreover, drawing 1 is a flow chart which shows the operation gestalt of the cooling water pump 5 and city water feed pump 9 under generation of electrical energy of the fuel cell system in the gestalt of operation of the 1st of this invention, and after a generation-of-electrical-energy halt.

[0023] Actuation of the fuel cell system by the gestalt of this operation which has the above configurations is explained below.

[0024] A fuel cell 1 generates power and heat from the fuel gas which was rich in the hydrogen generated with the fuel generation vessel 2, and the air which Blois 3 supplies.

[0025] The fuel generation machine 2 is maintained by the elevated temperature (about 700 degrees C) with the burner (not shown) which burns natural gas etc. in order to generate the fuel gas which added water in generation-of-electrical-energy raw materials, such as natural gas, and was rich in hydrogen.

[0026] The heat generated with the fuel cell 1 is conveyed outside with the cooling water which flows the inside of the cooling piping 4. The flow rate of cooling water adjusts the conveyance capacity of the cooling water pump 5 whose temperature Tf of the cooling water which the fuel cell temperature detector 10 installed in the place where cooling water flows out of a fuel cell 1 detects corresponds with the target temperature Tr1 (about 70 degrees C). Here, you may consider that the temperature as which the fuel cell temperature detector 10 detects temperature since it is thought that the temperature of a fuel cell 1 is almost equal to the temperature which flows out of a fuel cell 1 is the temperature of a fuel cell 1.

[0027] The heat which cooling water obtained is transmitted to the city water which flows the inside of the city-water piping 8 through a heat exchanger 6. The flow rate of a city water adjusts the conveyance capacity of a city water feed pump 9 so that the temperature Tw of the city water which the city-water temperature detector 11 installed in the place where a city water flows out of a heat exchanger 6 detects may be in agreement with the target temperature Tr2 (about 60 degrees C).

[0028] Next, in case a generation of electrical energy of a fuel cell 1 is ended, the combustible gas which remains inert gas, such as nitrogen, at suspending supplying material gas and water to the fuel generation machine 2 and coincidence in delivery, a fuel generation machine, a distribution channel, and a fuel cell 1 to both the distribution channel of the material gas from the fuel generation machine 2 to a fuel cell 1 and fuel gas and the distribution channel of the material gas in a fuel cell 1 and fuel gas is discharged out of a fuel cell system.

[0029] Although the actuation to the above is the same as that of the fuel cell system of the conventional example, future actuation is explained with reference to the flow chart of drawing 1 .

[0030] First, the fuel cell temperature detector 10 detects the temperature Tf of the cooling water which flows out of a fuel cell 1 equivalent to the temperature of a fuel cell 1 (001).

[0031] When the detected temperature Tf is higher than the target temperature Tr1 defined beforehand, cooling water conveyance capacity of a cooling water pump 5 is enlarged, and conversely, when the detected temperature Tf is lower than the target temperature Tr1, cooling water conveyance capacity of a cooling water pump 5 is made small (002). What is necessary is here, to calculate the cooling water conveyance power of a cooling water pump 5 using the PID controller generally used, so that the temperature Tf of cooling water may be in agreement with the target temperature Tr1, and just to operate a cooling water pump 5, in order to determine the cooling water conveyance capacity of a cooling water pump 5.

[0032] Then, the city-water temperature detector 11 detects the temperature Tw of the city water which flows out of a heat exchanger 6 (003).

[0033] When the detected temperature Tw is higher than the target temperature Tr2 defined beforehand, city-water conveyance capacity of a city water feed pump 9 is enlarged, and conversely, when the detected temperature Tw is lower than the target temperature Tr2, city-water conveyance capacity of a city water feed pump 9 is made small (004). What is necessary is here, to calculate the city-water conveyance power of a city water feed pump 9 using the PID controller generally used, so that the temperature Tw of a city water may be in agreement with the target temperature Tr2, and just to operate a city water feed pump 9, in order to determine the city-water conveyance capacity of a city water feed pump 9.

[0034] Next, the controller of the system which is not illustrated judges whether a generation-of-electrical-

energy halt of the fuel cell system is carried out (005), and if it is [generation-of-electrical-energy] under continuation, operation based on return and the above-mentioned flow will be again repeated to processing 002.
[0035] On the other hand, although supply of the fuel gas from the fuel generator 2 and supply of the air from Blois 3 stop and installation of the inert gas to the fuel generation machine 2 and a fuel cell 1 is started when a generation of electrical energy of a fuel cell 1 is suspended The fuel cell temperature detector 10 measures the threshold temperature Te 1 (about 60 degrees C) beforehand determined as the temperature Tf of cooling water (006), and when the temperature Tf of cooling water is higher than the threshold temperature Te 1 (about 60 degrees C), it repeats operation based on return and the above-mentioned flow to processing 002.
[0036] When the temperature Tf of cooling water becomes lower than the threshold temperature Te 1 (about 60 degrees C), operation of a cooling water pump 5 and a city water feed pump 9 is suspended.
[0037] As mentioned above, the cooling water pump 5 and city water feed pump 9 for conveying to the exterior the heat which a fuel cell 1 emits in the gestalt of this operation Even if a fuel cell 1 carries out a generation-of-electrical-energy halt, in order to continue operating, even if it sends inert gas, such as nitrogen, to the distribution channel of the material gas of the fuel generation machine 2 and a fuel cell 1, and fuel gas to a fuel cell 1 Since the heat which the residual fuel gas of the high temperature conveyed by inert gas and inert gas holds is discharged through cooling water outside, partially, a fuel cell 1 does not become an elevated temperature. Therefore, even if it uses the solid-state macromolecule mold for the fuel cell 1, the situation which a solid-state poly membrane dries partially does not occur, and the situation of reducing the generating efficiency of a fuel cell 1 remarkably is not generated.
[0038] Moreover, it becomes possible by making it stop, when it continues operating a cooling water pump 5 and a city water feed pump 9 even if the fuel cell 1 carried out a generation-of-electrical-energy halt when suspending the generation of electrical energy of a fuel cell system, and the temperature Tf of cooling water becomes lower than the threshold temperature Te 1 to collect efficiently the heat generated at the time of a generation of electrical energy of a fuel cell 1.
[0039] Moreover, since a cooling water pump 5 and a city water feed pump 9 are suspended when the temperature Tf of cooling water is lower than the threshold temperature Te 1, it is possible not to reduce the temperature of the city water which is carrying out hot water storing beyond the need, and to maintain the hot water storing of a city water at the high temperature of utility value.
[0040] (Gestalt of the 2nd operation) Next, the gestalt of operation of the 2nd of this invention is explained with reference to a drawing.
[0041] The gestalt of this operation is also the same with the gestalt of the 1st operation, and since it has the same configuration as the fuel cell system of the conventional example, this detailed explanation shall apply to explanation at the thing of the fuel cell system in the gestalt of operation of the 1st of this invention using drawing 3 .
[0042] Moreover, drawing 2 is a flow chart which shows the operation gestalt of the cooling water pump 5 and city water feed pump 9 under generation of electrical energy of the fuel cell system in the gestalt of operation of the 2nd of this invention, and after a generation-of-electrical-energy halt.
[0043] Actuation of the fuel cell system by the gestalt of this operation which has the above configurations is explained below.
[0044] First, the fuel cell temperature detector 10 detects the temperature Tf of the cooling water which flows out of the fuel cell 1 equivalent to the temperature of a fuel cell 1 (001).
[0045] When the detected temperature Tf is higher than the target temperature Tr1 defined beforehand, cooling water conveyance capacity of a cooling water pump 5 is enlarged, and conversely, when the detected temperature Tf is lower than the target temperature Tr1, cooling water conveyance capacity of a cooling water pump 5 is made small (002). What is necessary is here, to calculate the cooling water conveyance power of a cooling water pump 5, and just to operate a cooling water pump 5 using the PID controller generally used, so that the temperature Tf of cooling water may be in agreement with the target temperature Tr1 in order to determine the cooling water conveyance capacity of a cooling water pump 5.
[0046] Then, the city-water temperature detector 11 detects the temperature Tw of the city water which flows out of a heat exchanger 6 (003). When the detected temperature Tw is higher than the target temperature Tr2 defined beforehand, city-water conveyance capacity of a city water feed pump 9 is enlarged, and conversely, when the detected temperature Tw is lower than the target temperature Tr2, city-water conveyance capacity of a city water feed pump 9 is made small (004). What is necessary is here, to calculate the city-water conveyance power of a city water feed pump 9, and just to operate a city water feed pump 9 using the PID controller generally used, so that the temperature Tw of a city water may be in agreement with the target temperature Tr2 in order to determine the city-water conveyance capacity of a city water feed pump 9.
[0047] And the controller of the system which is not illustrated judges whether a generation-of-electrical-energy

halt of the fuel cell system is carried out (005), and if it is [generation-of-electrical-energy] under continuation, operation based on return and the above-mentioned flow will be again repeated to processing 002.
[0048] On the other hand, when a generation of electrical energy of a fuel cell 1 is suspended, the threshold temperature Te 2 (about 55 degrees C) beforehand determined as the temperature Tw of a city water is measured (006), and when the temperature Tw of a city water is higher than the threshold temperature Te 2 (about 55 degrees C), operation based on return and the above-mentioned flow is repeated to processing 002.
[0049] When the temperature Tw of a city water becomes lower than the threshold temperature Te 2 (about 55 degrees C), operation of a cooling water pump 5 and a city water feed pump 9 is suspended.
[0050] As mentioned above, in the gestalt of this operation, when suspending a generation of electrical energy of a fuel cell system, it sets. By making it stop, when it continues operating the cooling water pump 5 and city water feed pump 9 for conveying to the exterior the heat which a fuel cell 1 emits even if the fuel cell 1 carried out a generation-of-electrical-energy halt, and the temperature Tw of a city water becomes lower than the threshold temperature Te 2 It generates at the time of a generation of electrical energy of a fuel cell 1, and it becomes possible to also collect efficiently the heat currently maintained in the fuel cell 1 after the halt of a generation of electrical energy.
[0051] Moreover, since a cooling water pump 5 and a city water feed pump 9 are suspended when the temperature Tw of a city water is lower than the threshold temperature Te 2, it is possible not to reduce the temperature of the city water which is carrying out hot water storing beyond the need, and to maintain the hot water storing of a city water at the high temperature of utility value.
[0052] Moreover, in order to decide the timing which suspends a cooling water pump 5 and a city water feed pump 9 at the temperature of the city water which actually uses heat, it becomes manageable [whenever / exact temperature-of-stored-hot-water].
[0053] Furthermore, like the gestalt of the 1st operation, even if it sends inert gas, such as nitrogen, to the distribution channel of the material gas of the fuel generation machine 2 and a fuel cell 1, and fuel gas on the occasion of a generation-of-electrical-energy halt to a fuel cell 1, since the heat which the residual fuel gas of the high temperature conveyed by inert gas and inert gas holds is discharged through cooling water outside, partially, a fuel cell 1 does not become an elevated temperature. Therefore, even if it uses the solid-state macromolecule mold for the fuel cell 1, the situation which a solid-state poly membrane dries partially does not occur, and the situation of reducing the generating efficiency of a fuel cell 1 remarkably is not generated.
[0054] In the gestalt of operation of the 1st of this invention, and the gestalt of the 2nd operation the target temperature Tr1 of a fuel cell 1 In addition, 70 degrees C, Although target temperature Tr2 of a city water is made into 60 degrees C, the target temperature Tr1 is not what it should be set as the temperature to which a generation of electrical energy of a fuel cell 1 is carried out efficiently, and is restricted to 70 degrees C. The target temperature Tr2 should also be set as the temperature desired as temperature which collects a city water to a hot water reservoir tank 7, and is not restricted to 60 degrees C.
[0055] Moreover, although came, it was [operation of a cooling water pump 5 and a city water feed pump 9 was suspended,] with the gestalt of operation of the 1st of this invention and temperature Te 1 was made into 60 degrees C, the loss in a heat exchanger 6 is considered to the temperature desired as temperature which collects a city water to a hot water reservoir tank 7, and it should be set up on abundance, and does not restrict to 60 degrees C.
[0056] Furthermore, although it was the gestalt of operation of the 2nd of this invention, and came, it was [operation of a cooling water pump 5 and a city water feed pump 9 was suspended,] and temperature Te 2 was made into 55 degrees C, it should be set as the temperature desired as temperature which collects a city water to a hot water reservoir tank 7, and does not restrict to 55 degrees C.
[0057] Moreover, in the gestalt of each above-mentioned operation, a fuel cell 1 is an example of the fuel cell of this invention, and the cooling piping 4 is an example of the cooling circulatory system of this invention. Moreover, a cooling water pump 5 is an example of the heat carrier circulation means of this invention, a heat exchanger 6 and a city water feed pump 9 are the heat dissipation means of this invention, or an example of a heat exchanger, and the fuel cell thermometric element 10 and the city-water temperature detector 11 are examples of the temperature detection means of this invention. Moreover, the cooling water which has the inside of the cooling piping 4 conveyed is an example of the 1st heat carrier of this invention, and the city water which has the inside of the city-water piping 8 conveyed is an example of the 2nd heat carrier of this invention.
[0058] However, this invention is not limited to the configuration of the gestalt of the above-mentioned operation, and the temperature detection means of this invention measures the temperature of a fuel cell 1 directly, and you may make it acquire the temperature. Moreover, you may make it measure the temperature of a heat exchanger 11. You may make it measure the temperature of the city-water piping 8. In short, the temperature detection means of this invention is not limited by the measurement part that what is necessary is to

be able to detect the temperature of a fuel cell directly or indirectly, or just to be able to detect the temperature of the 2nd heat carrier of this invention.
[0059] Moreover, it is not necessary to limit to cooling water ($H2O$), and otherwise, the antifreezing solution etc. is insulation and the 1st heat carrier of this invention should just be a medium which can enough be supported about the heat of a fuel cell.
[0060] Moreover, the heat dissipation means of this invention may be the configuration that omits the hot-water-storing layer 7 and the city-water piping 8, and a heat exchanger 6 emits heat into air. In this case, it will operate until only the pump 5 corresponding to a heat carrier circulation means becomes a predetermined threshold. Moreover, heat dissipation means may be the configurations that actuation for heat dissipation is performed, such as circulation of a heat carrier, or after the fuel to a fuel cell and the supply interruption of an oxidizer may operate [a heat carrier circulation means].
[0061] After a generation-of-electrical-energy halt of a fuel cell 1, the temperature Tr of cooling water becomes lower than the threshold temperature Te 1 (about 60 degrees C), or above this inventions become possible [collecting efficiently the heat which the fuel cell 1 generated during the generation of electrical energy] by continuing operation of a cooling water pump 5 and a city water feed pump 9 until the temperature Tw of a city water becomes lower than the threshold temperature Te 2 (about 55 degrees C). Since a cooling water pump 5 and a city water feed pump 9 are suspended when the temperature of cooling water or a city water becomes lower than threshold temperature, it is possible not to reduce the temperature of the city water which is carrying out hot water storing beyond the need, and to maintain the hot water storing of a city water at the high temperature of utility value.
[0062] Moreover, in order not to cause the temperature rise of the fuel cell 1 by the inert gas which has passed material gas and a fuel gas path after a generation-of-electrical-energy halt, even if it uses the solid-state macromolecule mold for the fuel cell 1, the situation which a solid-state poly membrane dries partially does not occur, but it does not generate but the reliable fuel cell system distribution of the situation of reducing the generating efficiency of a fuel cell 1 remarkably becomes possible.
[0063]
[Effect of the Invention] This invention can offer the fuel cell system which does not cause the situation of reducing the generating efficiency of a fuel cell, after generation-of-electrical-energy termination so that clearly from the place explained above.
[0064] Moreover, the heat generated with the fuel cell can be efficiently taken out to the exterior, and the fuel cell system which uses heat with an effective gestalt can be offered.

[Translation done.]